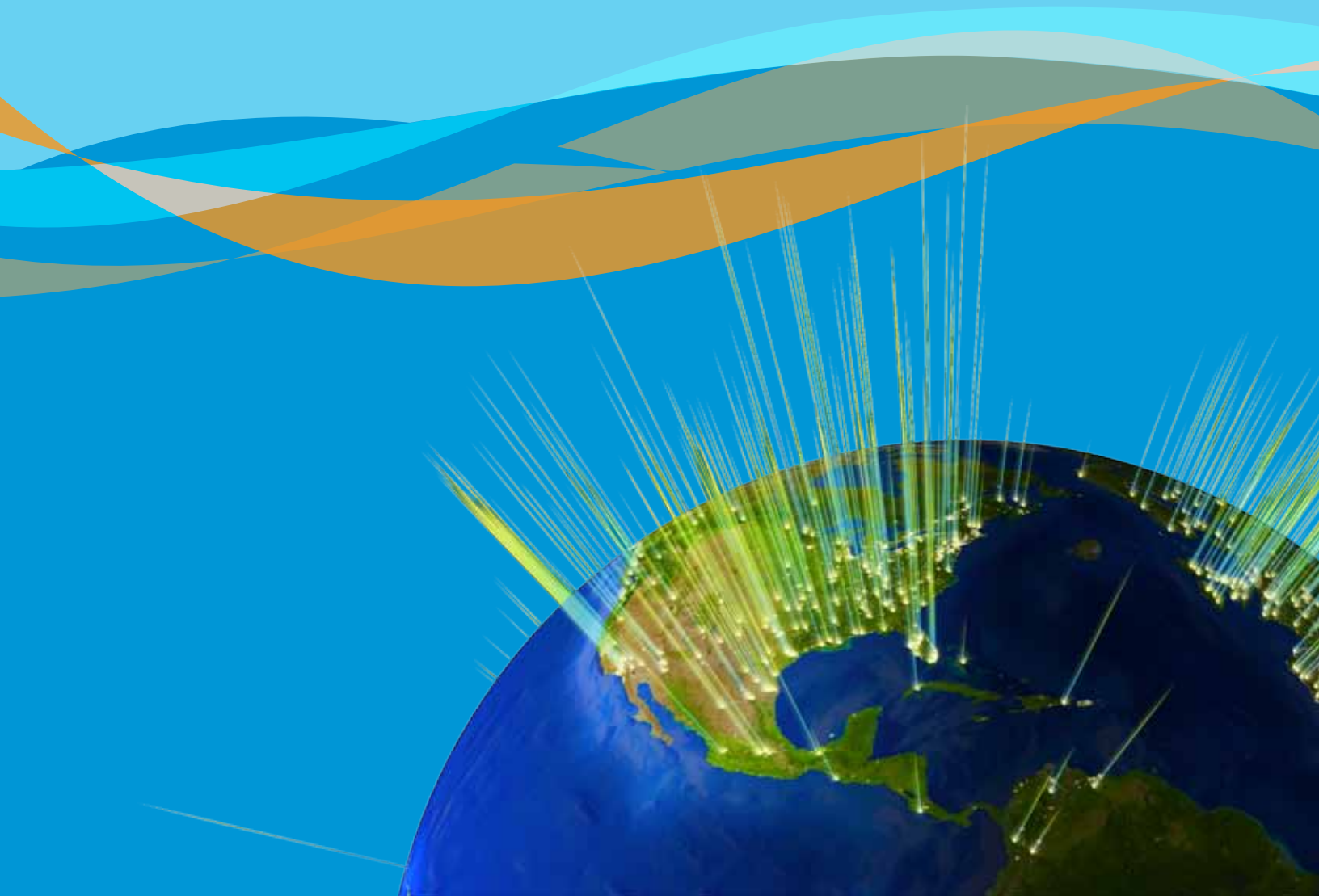
Akamai Volume 2, Number 4

REPORT

4th Quarter, 2009

The State of the Internet



The "spinning globe" featured in the Akamai NOCC represents where Akamai servers are located and how much traffic they are seeing.

Executive Summary

Each quarter, Akamai publishes a "State of the Internet" report. This report includes data gathered from across Akamai's global server network about attack traffic, broadband adoption, and mobile connectivity, as well as trends seen in this data over time. Periodically, it also aggregates publicly available news and information about notable events seen throughout the quarter, including Denial of Service attacks, Web site hacks, and network events, including outages and new connections. (In this quarter's edition, due to time constraints, this aggregated information has not been included.)

During the fourth quarter of 2009, Akamai observed attack traffic originating from 198 unique countries around the world. Russia remained the top attack traffic source, accounting for 13% of observed attack traffic in total. The United States and China bumped Brazil back down into fourth place, returning to the second and third place spots respectively, and accounting for nearly 20% of observed attack traffic. Akamai observed attack traffic targeted at more than 10,000 unique ports, with the top 10 ports once again seeing nearly 92% of the observed attack traffic, down slightly from 95% in the third quarter. (We believe that the increase in unique targeted ports is due to "noise" related to random port scanning activity.)

Akamai observed a 4.7% increase (from the third quarter of 2009) globally in the number of unique IP addresses connecting to Akamai's network. Ending 2009 at 465 million unique IPs, the metric grew 16% from the end of 2008, and nearly 54% from the end of 2007. From a global connection speed perspective, South Korea continued to have the highest level of "high broadband" (>5 Mbps) connectivity and also maintained the highest average connection speed, at nearly 12 Mbps. In the United States, Delaware remained in the top position, growing to 72% of connections to Akamai occurring at 5 Mbps or greater. Delaware also maintained the highest average connection speed in the United States, increasing to 7.6 Mbps.

In the fourth quarter, average measured connection speeds on mobile network providers around the world ranged from 3.2 Mbps on an Austrian mobile provider, down to 106 Kbps on a mobile provider in Slovakia. Over 40 of the mobile network providers listed in the report achieved average connection speeds above 1 Mbps. Among the three mobile network providers in the United States that were included in the *3rd Quarter, 2009 State of the Internet* report, two saw quarterly speed declines, while a quarterly increase was seen on the third.

Table of Contents

1: INTRODUCTION	3
2: SECURITY	4
2.1 Attack Traffic, Top Originating Countries	4
2.2 Attack Traffic, Top Target Ports	5
3: INTERNET PENETRATION	6
3.1 Unique IP Addresses Seen By Akamai	6
3.2 Global Internet Penetration	8
3.3 United States Internet Penetration	9
4: GEOGRAPHY	10
4.1 Global Average Connection Speeds	11
4.2 Global Average Connection Speeds, City View	13
4.3 United States Average Connection Speeds	13
4.4 United States Average Connection Speeds, City View	14
4.5 Global High Broadband Connectivity	15
4.6 Global High Broadband Connectivity: Speed Distribution	17
4.7 United States High Broadband Connectivity	18
4.8 United States High Broadband Connectivity: Speed Distribution	19
4.9 Global Broadband Connectivity	20
4.10 United States Broadband Connectivity	21
4.11 Global Narrowband Connectivity	23
4.12 United States Narrowband Connectivity	24
5: MOBILE	25
6: APPENDIX	27
7: ENDNOTES	28

Introduction

Akamai's globally distributed network of servers allows us to gather massive amounts of information on many metrics, including connection speeds, attack traffic, and network connectivity/availability/latency problems, as well as traffic patterns on leading Web sites.

In the fourth quarter of 2009, observed attack traffic continued to target a consistent set of ports, and attacks targeting port 445 continued to be responsible for an overwhelming percentage of the observed attacks. Russia remained the top source of observed attack traffic, followed very closely by the United States – in aggregate, the two countries were responsible for a quarter of the observed attack traffic.

In the fourth quarter of 2009, the quarterly change in average connection speeds among countries around the world was generally positive, and most countries continued to see increasing speeds on a year-over-year basis as well. In addition, the quarterly change in high broadband (connections to Akamai's network at speeds in excess of 5 Mbps) adoption was generally positive, with many countries seeing increased high broadband adoption on a year-over-year basis as well. Globally, the percentage of connections to Akamai at narrowband (below 256 Kbps) speeds increased an unexpected 41% in the fourth quarter of 2009. However, in some countries, we believe that growing traffic from slower mobile connections is having a measurable impact on average speed calculations. While the growth in mobile usage likely does not impact the countries that historically have the highest levels of narrowband adoption, it may serve to inflate narrowband percentages within developed nations. This quarterly increase in narrowband connections does not necessarily presage a shift towards reduced availability of higher speed Internet connections, as other measures continue to point to continued growth of high-speed Internet connectivity.

In response to the growing amount of Internet content being accessed through mobile devices such as smartphones and laptops equipped with mobile broadband connection technologies, and also in response to multiple inquiries for such data, Akamai has begun publishing insights into metrics collected from connections to Akamai that have been identified as coming from networks associated with mobile providers. During the fourth quarter of 2009, average connection speeds from three of the leading mobile providers within the United States were analyzed and determined to be in the 600-800 Kbps range, while speeds across a global distribution of mobile network providers ranged from 100 Kbps to 3.2 Mbps.

Due to production time constraints, the *4th Quarter, 2009 State of the Internet* report does not include aggregated publicly available news and information about notable events seen throughout the quarter, including Denial of Service attacks, Web site hacks, and network events, including outages and new connections. However, we plan to return to including this information in future reports.

SECTION 2: Security

Akamai maintains a distributed set of agents deployed across the Internet that serve to monitor attack traffic. Based on the data collected by these agents, Akamai is able to identify the top countries from which attack traffic originates, as well as the top ports targeted by these attacks. (Ports are network layer protocol identifiers.) This section, in part, provides insight into Internet attack traffic, as observed and measured by Akamai, during the fourth quarter of 2009. While some quarter-over-quarter trending may be discussed, it is expected that both the top countries and top ports will change on a quarterly basis.

2.1 Attack Traffic, Top Originating Countries

Akamai observed attack traffic originating from 198 unique countries around the world.

During the fourth quarter of 2009, Akamai observed attack traffic originating from 198 countries. This count is down from 207 in the prior quarter. Similar to the last quarter, Russia continued to hold the top spot, again originating 13% of observed attack traffic, as shown in Figure 1. The United States moved back up into second place, originating attack traffic at nearly double the level seen in the third quarter. Brazil fell to fourth place from the number 2 slot in the third quarter. Despite the movement within the rankings, the set of countries making up the top ten remained consistent quarter-over-quarter. Attack concentration among the top 10 countries was up just slightly over the prior quarter, accounting for 63% of observed attacks.

Once again, Port 445 was overwhelmingly the top port targeted by attacks among the top ten countries, in some cases by orders of magnitude more than the next most targeted port. While this may indicate continued activity from Conficker and its variants within these countries, it may also indicate a resurgence of older worms such as Lioten, Randex, and Deloader, based on comments posted to the SANS Internet Storm Center page for Port 445[1]. However, because Akamai does not analyze the payloads of these attempted attacks, we cannot confirm whether they are definitively associated with any of the above named worms. In a majority of the top ten countries, the second most targeted port was 22 or 23, potentially indicating brute force login attempts over SSH or Telnet.

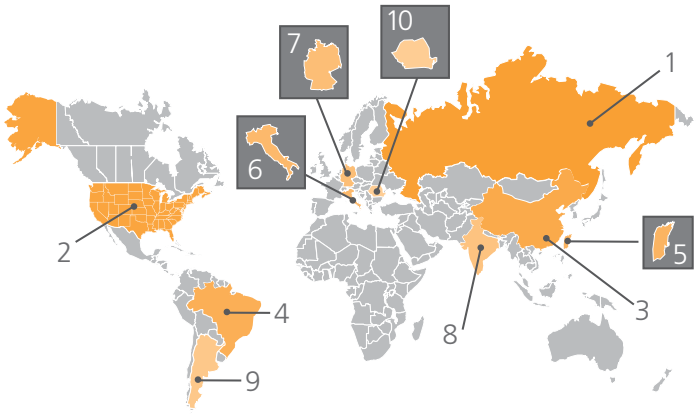


Figure 1: Attack Traffic, Top Originating Countries

	Country/Region	% Traffic	Q3 09%
1	Russia	13%	13%
2	United States	12%	6.9%
3	China	7.5%	6.5%
4	Brazil	6.4%	8.6%
5	Taiwan	5.5%	5.1%
6	Italy	4.5%	5.4%
7	Germany	4.4%	4.8%
8	India	3.3%	3.4%
9	Argentina	3.1%	3.6%
10	Romania	3.0%	3.2%
-	Other	37%	39%

2.2 Attack Traffic, Top Target Ports

During the fourth quarter of 2009, Akamai observed attack traffic targeted at more than 10,000 unique ports, which is a significant increase from the 3,800 observed in the third quarter. However, more than half of these ports saw only a single attempted attack (connection attempt), which likely indicates that they were the target of a port scan, rather than the targets of intentional attacks. Similar to the *1st Quarter, 2009 State of the Internet* report, when observed attack traffic targeted over 20,000 unique ports, we can attempt to filter out some of this "noise" from what are likely random port scans by applying threshold filters. If we look at ports that had more than one attempted attack, we would be left with approximately 4,800 unique ports, discarding over half of the original set, as mentioned above. At a threshold of 10 attempted attacks, we are left with just 222 unique ports, and increasing the threshold to 100 attempted attacks thins the field significantly, leaving only 32 unique ports. Looking at the source data, it appears that the top source of what was likely port scan traffic was the United States, which originated single connection attempts to over 4100 unique ports. A distant second was India, which originated single connection attempts to just over 600 unique ports.

For the seventh consecutive quarter, attacks targeted at Port 445 were responsible for the highest percentage of the observed attacks.

Attack concentration dropped slightly quarter-over-quarter, as shown in Figure 2, with port 445 responsible for just under three-quarters of observed attacks, and the top 10 targeted ports responsible for just under 92% of observed attacks. The top 10 targeted ports remained consistent from the third quarter, though some position shifting occurred throughout the list.

If the thresholds described above are applied, the top 10 ports obviously remain the same, though the percentages wind up increasing slightly for some of the ports – for instance, port 445 grows to 75%, 77%, and 78% of observed attack traffic when the 1, 10, and 100 attempted attacks thresholds are applied, respectively. Only minor variations occur in the balance of the ports; though the percentages for "Other" drop to 7.1%, 4.0%, and 2.9% respectively for the 1, 10, and 100 attempted attacks thresholds.

Destination Port	Port Use	% Traffic	Q3 09%
445	Microsoft-DS	74%	78%
22	SSH	5.2%	2.0%
139	NetBIOS	2.8%	3.2%
135	Microsoft-RPC	2.8%	2.8%
23	Telnet	2.5%	4.4%
80	WWW	1.5%	0.9%
4899	Remote Administrator	1.1%	1.3%
1433	Microsoft SQL Server	0.9%	0.8%
5900	VNC Server	0.8%	1.0%
25	SMTP	0.5%	0.4%
Various	Other	8.3%	-

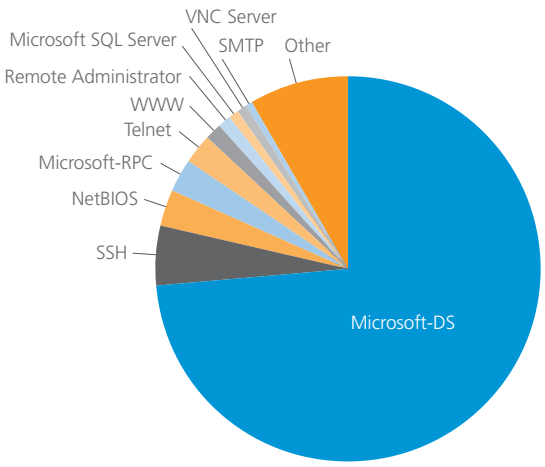


Figure 2: Attack Traffic, Top Traffic Ports

SECTION 3: Internet Penetration

3.1 Unique IP Addresses Seen By Akamai

Through a globally-deployed server network, and by virtue of the billions of requests for Web content that it services on a daily basis, Akamai has unique visibility into the levels of Internet penetration around the world. In the fourth quarter of 2009, slightly more than 465 million unique IP addresses, from 234 countries, connected to the Akamai network – 4.7% more than in the third quarter of 2009, and 16% more than in the same quarter a year ago. These quarterly and yearly changes were roughly consistent with the growth levels seen in the third quarter of 2009 as well.

In the fourth quarter of 2009, over 465 million unique IP addresses connected to the Akamai network.

As this report closes out the second full year of *State of the Internet* reports from Akamai, we thought it would interesting to look at the overall trending of global Internet penetration. As shown in Figure 3, the quarterly growth in unique IP addresses seen by Akamai has been as high as 9.7% (Q3 2008), and as low as 1.2% (Q2 2009). On average, quarterly growth in unique IP addresses appears to converge around the 5% level. In looking at the yearly growth rates, an interesting trend appears, as the rate of growth over time is clearly slowing. Over the last two years (Q4 2007 to Q4 2009), the number of unique IP addresses seen by Akamai has grown nearly 54%, from 302 million to 465 million. While part of the slowing growth may be related to the so-called "law of large numbers," where it becomes harder to sustain the (early) higher growth rates over time, the trend more likely points to the growing ubiquity of Internet connectivity. As more and more people are connected to the Internet, whether through fixed or mobile connections, the "disconnected" are becoming an increasingly smaller percentage of the global population. In addition, this slowing growth rate may also point at the increasing use of network address translation (NAT) and proxy/gateway technology within last mile and mobile networks, as providers attempt to cope with continued growth of their subscriber counts, as well as the impending exhaustion of available IPv4 addresses.

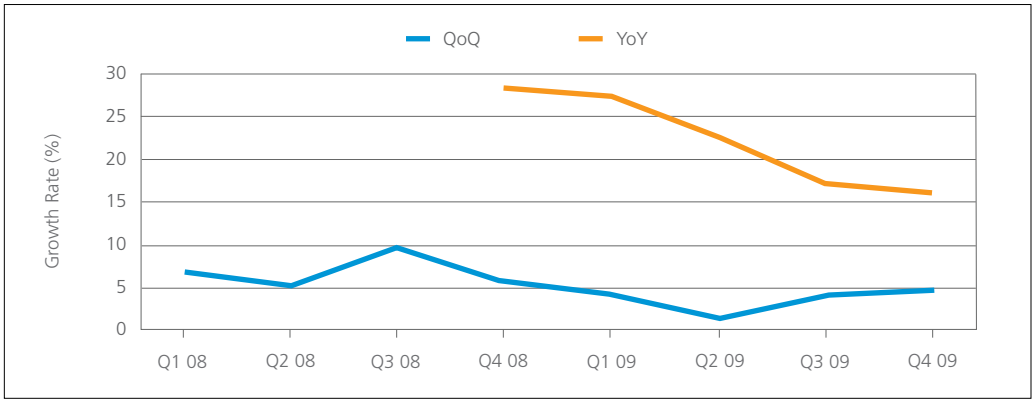


Figure 3: Quarterly and Yearly Growth Rates, Unique IP Addresses Seen By Akamai

For the seventh consecutive quarter, the United States and China continued to account for nearly 40% of the observed IP addresses. As shown in Figure 4, the top 10 countries remained the same quarter-over-quarter, though Brazil and Spain once again exchanged places at the bottom of the list. Among the top 10 countries, the quarterly growth in the number of unique IP addresses seen by Akamai was modest. Interestingly, last quarter's greatest gainer, Brazil, was the only country among the top 10 to see a decline in the fourth quarter. Globally, 57 countries saw a quarterly decline in unique IP counts in the fourth quarter, though a number of these were places where Akamai observed just tens or hundreds of IPs. Concentration among the top 10 remained consistent as well, accounting for approximately 71% of the observed IP addresses for the second consecutive quarter.

Looking at the "long tail," there were 186 countries with fewer than one million unique IP addresses connecting to Akamai in the fourth quarter of 2009, 145 with fewer than 100,000 unique IP addresses, and 32 with fewer than 1,000 unique IP addresses. All three counts are up slightly from prior quarters, but this may be due to an expansion of the geographic database used to identify countries – several countries are now classified independently, where they had not been in prior quarters.

	Country/ Region	Q4 09 Unique IPs	QoQ Change	YoY Change
-	Global	465,019,509	4.7%	16%
1	United States	124,953,865	4.5%	11%
2	China	52,113,869	6.2%	27%
3	Japan	32,259,547	1.9%	12%
4	Germany	30,912,466	3.9%	10%
5	France	21,477,486	2.8%	16%
6	United Kingdom	20,008,664	3.2%	11%
7	South Korea	16,108,106	5.3%	7.7%
8	Canada	11,402,213	1.6%	4.8%
9	Spain	10,822,929	3.9%	12%
10	Brazil	10,779,132	-0.3%	18%

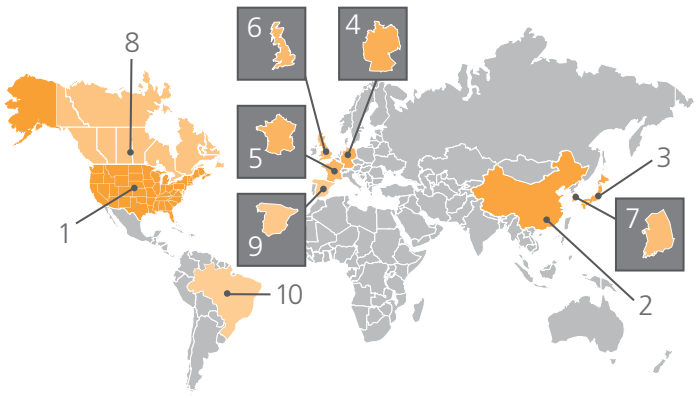


Figure 4: Unique IP Addresses Seen By Akamai

3.2 Global Internet Penetration

How does the number of unique IP addresses seen by Akamai compare to the population of each of those countries? Asked another way, what is the level of Internet penetration in each of those countries? Using global population data[2] from the United States Census Web site as a baseline, levels of Internet penetration for each country around the world were calculated based on Akamai's view into Internet traffic. These per capita figures should be considered as an approximation, as the population figures used to calculate them are static estimates – obviously, they will change over time, and it would be nearly impossible to obtain exact numbers on a quarterly basis. In addition, individual users can have multiple IP addresses (handheld, personal/home system, business laptop, etc.). Furthermore, in some cases, multiple individuals may be represented by a single IP address (or small number of IP addresses), as they access the World Wide Web through a firewall or proxy server. Akamai believes that it sees approximately one billion users per day, though we see only approximately 465 million unique IP addresses.

In comparing the unique IPs per capita figures for the fourth quarter, as shown in Figure 5, to those for the third quarter of 2009, we find that the same eight countries remained at the top of the list. However, the Falkland Islands and British Virgin Islands were edged out of the bottom two slots in the top 10 by Germany and Australia, both of which saw quarterly growth of between 3-4%. Monaco's jump from seventh to fourth place pushed the United States down to sixth place. Globally, 35 countries once again have Internet penetration levels of 25% or greater (0.25 or more unique IPs per capita), while 73 countries also once again have levels of 10% or more (0.10 or more unique IPs per capita). Internet penetration rates of one percent or less were calculated for 87 countries in the fourth quarter of 2009.

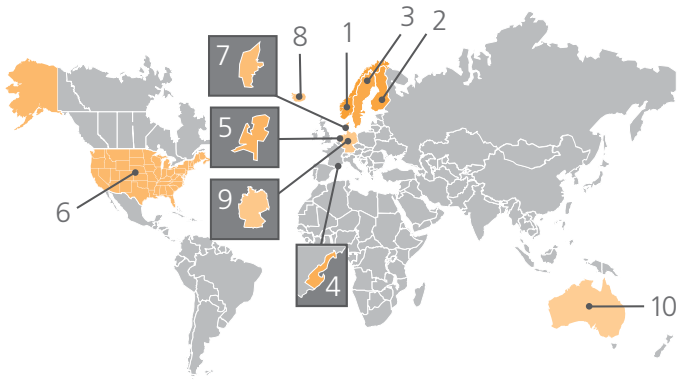


Figure 5: Global Internet Penetration

	Country/ Region	Unique IPs per Capita
-	Global	0.07
1	Norway	0.49
2	Finland	0.44
3	Sweden	0.43
4	Monaco	0.41
5	Netherlands	0.41
6	United States	0.40
7	Denmark	0.39
8	Iceland	0.39
9	Germany	0.38
10	Australia	0.37

3.3 United States Internet Penetration

Using state population estimates available from the United States Census Web site,[3] and the number of unique IP addresses from each state that Akamai observed in the fourth quarter of 2009, we calculated the levels of Internet penetration on a state-by-state basis – the top 10 states are shown in Figure 6. The same caveats noted above in Section 3.2, regarding per capita figures as an approximation, apply here as well.

As is evident in Figure 6, New Jersey once again tops the list, with a figure of over one unique IP per capita. In further analyzing the source data, we believe that this unusually high figure, and the significant growth seen over the last several quarters, is likely related to the growth in unique IP addresses associated with mobile carrier gateways located within the state. As such, it may be the case that traffic from mobile users in other states may actually be reaching the Internet through a gateway in New Jersey, thereby skewing the unique IP count, and as such, the unique IP per capita calculations. Going forward, in future issues of the *State of the Internet* report, traffic from known mobile network providers will be removed from the data set used to calculate this metric.

Having said that, most of the other states in the top 10 posted modest gains quarter-over quarter. Rhode Island was the lone decliner among the group, losing 0.8%, though remaining at 0.45 unique IPs per capita. Virginia saw the greatest quarterly increase among the top 10 states, growing 34%, due in part to the growth seen in unique IP addresses associated with mobile networks that have gateways in the state.

	State	Unique IPs per Capita
1	New Jersey	1.44
2	Georgia	0.71
3	Washington	0.63
4	Illinois	0.59
5	Missouri	0.54
6	Colorado	0.47
7	Utah	0.46
8	Massachusetts	0.45
9	Rhode Island	0.45
10	Virginia	0.44

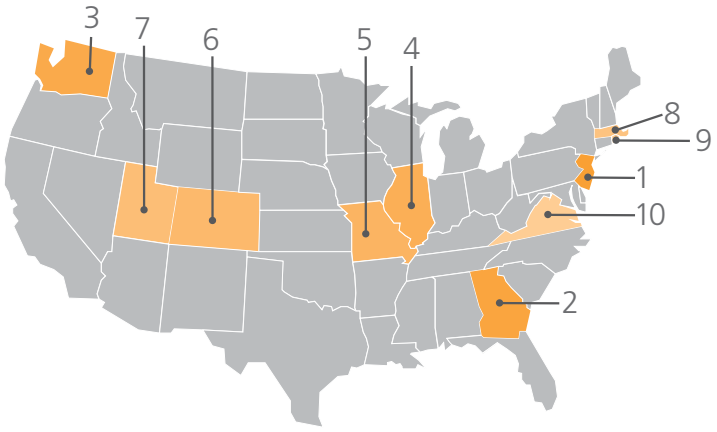


Figure 6: Internet Penetration in the United States

SECTION 4: Geography

Through its globally-deployed server network and by virtue of the billions of requests for Web content that it services on a daily basis, Akamai has a unique level of visibility into the connection speeds of the systems issuing the requests, and as such, of broadband adoption around the globe. Because Akamai has implemented a distributed network model, deploying servers within edge networks, it can deliver content more reliably and more consistently at those speeds, in contrast to centralized competitors that rely on fewer deployments in large data centers. For more information on why this is possible, please see Akamai's *How Will The Internet Scale?* White Paper[4] or the video explanation at http://www.akamai.com/whytheedge.

The data presented within this section was collected during the fourth quarter of 2009 through Akamai's globally-deployed server network and includes all countries and U.S. states that had more than 1,000 average monthly unique IP addresses make requests to Akamai's network during the second quarter. For purposes of classification in this report, the "broadband" data included below is for connections greater than 2 Mbps, and "high broadband" is for connections of 5 Mbps or greater. In contrast, the "narrowband" data included below is for connections slower than 256 Kbps. Note that the percentage changes reflected below are not additive – they are relative to the prior quarter(s). (That is, a Q3 value of 50% and a Q4 value of 51% would be reflected here as a 2% change.) A quarter-over-quarter change is shown within the tables in several sections below in an effort to highlight general trends. A year-over-year change is also shown in some tables in an effort to highlight longer-term trends.

As the quantity of HD-quality media increases over time, and the consumption of that media increases, end users are likely to require ever-increasing amounts of bandwidth. A connection speed of 2 Mbps is arguably sufficient for standard definition TV-quality video content, and 5 Mbps for standard-definition DVD quality video content, while Blu-Ray (1080p) video content has a maximum video bit rate of 40 Mbps, according to the Blu-Ray FAQ[5]. As we have done in prior quarters, in order to provide additional insight into where users have connection speeds that would allow them to be able to effectively consume this higher quality media, we will continue to examine how the "high broadband" connections are distributed across speed groupings ranging from 5 to >25 Mbps. In addition, we will continue to look at which cities around the world have the highest average measured connection speeds, and the highest levels of high broadband and broadband adoption.

Finally, we believe that mobile usage in many geographies around the world may be growing to the point where it is skewing average speed calculations, resulting in significant declines in [high] broadband metrics, or unusually large gains in narrowband metrics. Therefore, starting with the *1st Quarter, 2010 State of the Internet* report, traffic from known mobile network providers will be removed from the data set used to calculate the metrics reported in this section. (Mobile traffic will continue to be analyzed and reviewed in a separate section of the report.)

4.1 Global Average Connection Speeds

After a mixed third quarter, it appears that average measured connection speeds are once again on the rise across the top 10 fastest countries, as shown in Figure 7. Though it saw a very minor decline of just over 1%, the global average measured connection speed held steady at 1.7 Mbps (due to rounding). Of the top 10, eight countries saw quarterly increases in connection speeds, and eight of the top 10 also had higher average measured speeds at the end of 2009 than they did a year earlier.

One clear outlier in the data is South Korea, which lost 24% in the fourth quarter, returning it to levels seen in the first and second quarters of 2009. In exploring the source data, we noted that Akamai saw significant growth in the number of unique IPs associated with a specific mobile provider in the country. As the Apple iPhone launched in South Korea in November 2009,[6] it is likely that the growth in unique IPs seen on this mobile provider was associated with that launch. As the average observed connection speed for this mobile provider was a fraction of that observed from wireline connections in South Korea, we believe that this launch was likely responsible for the significant drop in South Korea's average observed connection speed in the fourth quarter.

During the fourth quarter, 96 countries had average connection speeds below 1 Mbps, down from 103 countries in the prior quarter. Akamai measured average connection speeds below 100 Kbps in only three countries in the fourth quarter – less than half as many as in the third quarter. (Note that the slowest countries often have the smallest number of unique IP addresses connecting to Akamai, so it may be the case that more countries fell below the 1000 unique IP threshold in the fourth quarter than in the third quarter.) The lowest average measured connection speed seen in the fourth quarter was once again in Mayotte, at 40 Kbps, declining 6.5% from the prior quarter.

	Country/ Region	Q4 09 Mbps	QoQ Change	YoY Change
-	Global	1.7	-1.2%	-2.7%
1	South Korea	11.7	-24%	-29%
2	Hong Kong	8.6	11%	17%
3	Japan	7.6	-4.0%	6.8%
4	Romania	7.2	14%	28%
5	Latvia	6.2	23%	28%
6	Sweden	6.1	5.8%	2.0%
7	Netherlands	5.3	1.9%	10%
8	Czech Republic	5.2	9.1%	17%
9	Denmark	5.2	8.8%	16%
10	Switzerland	5.1	3.7%	-0.4%
...				
22	United States	3.8	-0.9%	-2.5%

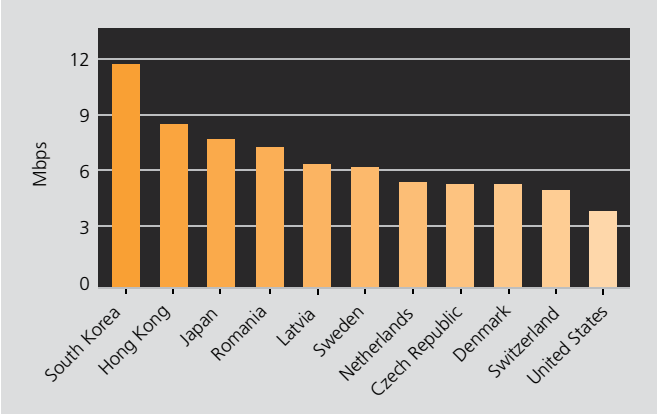


Figure 7: Average Measured Connection Speed by Country/Region

SECTION 4: Geography (continued)

	REGION	CITY	Q4 09 KBPS
1	United States	Berkeley, CA	18730
2	United States	Chapel Hill, NC	17483
3	United States	Stanford, CA	16956
4	South Korea	Masan	14969
5	Great Britain	Oxford, England	14463
6	South Korea	Iksan	14370
7	Taiwan	Taoyuan	14297
8	United States	Durham, NC	13636
9	United States	Ithaca, NY	13265
10	United States	Ann Arbor, MI	13178
11	United States	College Station, TX	13129
12	South Korea	Poryong	13007
13	South Korea	Koyang	12965
14	South Korea	Milyang	12874
15	South Korea	Suwon	12466
16	South Korea	Chonju	12190
17	South Korea	Seocho	12126
18	Japan	Tokai	11971
19	South Korea	Ilsan	11911
20	Japan	Usen	11886
21	Japan	Ginza	11799
22	United States	Urbana, IL	11764
23	South Korea	Seoul	11709
24	United States	Cambridge, MA	11708
25	Japan	Sakae	11208
26	Japan	Kanagawa	11131
27	Japan	Ibaraki	11108
28	United States	University Park, PA	11066
29	United States	East Lansing, MI	10776
30	Norway	Trondheim	10615
31	Japan	Urawa	10596
32	Japan	Shimotsuma	10539
33	United States	Athens, GA	10265
34	Japan	Tochigi	10247
35	United States	Bloomington, IN	10136
36	Netherlands	Enschede	10025
37	Japan	Shizuoka	9796
38	Czech Republic	Brno	9743
39	Japan	Asahi	9540
40	Sweden	Umea	9447
41	United States	Boulder, CO	9308
42	United States	Riverside, CA	9208
43	United States	Fort Collins, CO	9078
44	Japan	Kyoto	8987
45	Romania	Constanta	8947
46	Japan	Nagoya	8896
47	Taiwan	Tainan	8839
48	Japan	Hyogo	8804
49	Japan	Marunouchi	8768
50	Japan	Gifu	8762

	REGION	CITY	Q4 09 KBPS
51	Norway	Lyse	8754
52	Japan	Kobe	8587
53	Japan	Nagano	8575
54	Romania	Iasi	8547
55	Japan	Hakodate	8538
56	Hong Kong	Hong Kong	8522
57	Great Britain	Southampton, England	8371
58	Great Britain	Bristol, England	8292
59	United States	Muncie, IN	8281
60	Canada	Victoria, BC	8260
61	United States	Gainesville, FL	8233
62	Japan	Nara	8228
63	Japan	Chiba	8196
64	Japan	Sendai	8180
65	Romania	Timisoara	8091
66	Japan	Yokkaichi	8085
67	Japan	Hodogaya	8033
68	Japan	Niho	8002
69	Japan	Wakayama	7968
70	Japan	Otsu	7963
71	Netherlands	Groningen	7929
72	Canada	Kingston, ON	7902
73	Great Britain	Cambridge, England	7840
74	Japan	Hiroshima	7812
75	United States	Santa Barbara, CA	7798
76	Japan	Hamamatsu	7772
77	Japan	Fukuoka	7693
78	Japan	Matsuyama	7692
79	Japan	Soka	7647
80	Czech Republic	Ceska	7604
81	Japan	Kanazawa	7591
82	United States	Madison, WI	7526
83	Japan	Fukui	7520
84	Japan	Toyama	7485
85	Japan	Mito	7462
86	Japan	Yokohama	7441
87	Japan	Yamaguchi	7423
88	Japan	Tokyo	7409
89	Japan	Yamagata	7374
90	Taiwan	Kaohsiung	7367
91	Japan	Kokuryo	7313
92	Japan	Tokushima	7308
93	Japan	Okayama	7172
94	Japan	Utsunomiya	7171
95	United States	Monterey Park, CA	7123
96	Japan	Kochi	7114
97	Japan	Niigata	7101
98	Japan	Otemachi	7098
99	Japan	Kagoshima	7035
100	Sweden	Uppsala	7033

Figure 8: Average Measured Connection Speed, Top Global Cities

4.2 Global Average Connection Speeds, City View

Following the initial review published in the *3rd Quarter, 2009 State of the Internet* report, we are once again examining the average measured connection speeds at a city level. However, in an effort filter out some of the particularly small cities that may have been included in the third quarter's report, we applied a "filter" of 50,000 unique IP addresses to qualify for inclusion in the list. The top 100 fastest cities around the world, based on this filter, are shown in Figure 8. Once again, some very interesting clustering patterns can be seen when looking at this dataset:

- Nearly half (48) of the top cities are in Japan, and 62 of them are in Asia
- The 15 top cities that are located in Europe are spread across six countries
- Over a fifth (21) of the top cities are in the United States, and 23 of them are in North America

4.3 United States Average Connection Speeds

Quarterly changes in average measured connection speeds within the United States were mixed in the fourth quarter, as illustrated in Figure 9. Five of the top 10 states saw a quarterly increase, and five saw a decrease. The quarterly changes were fairly modest, at least as compared to those seen in the third quarter, where four states saw double-digit gains. Year-over-year, average measured connection speeds increased in eight of the top 10 states, while New Hampshire declined 8.7%, and Connecticut lost a barely perceptible 0.1%

	State	Q4 09 Mbps	QoQ Change	YoY Change
1	Delaware	7.6	5.2%	4.0%
2	Vermont	5.8	1.6%	7.7%
3	Massachusetts	5.7	-2.1%	2.7%
4	New Hampshire	5.6	-6.3%	-8.7%
5	Nevada	5.5	6.7%	6.5%
6	Indiana	5.4	7.9%	10.2%
7	Rhode Island	5.4	-3.5%	1.2%
8	New York	5.4	-1.8%	0.6%
9	Connecticut	5.4	-2.1%	-0.1%
10	Wisconsin	5.1	8.2%	12.5%

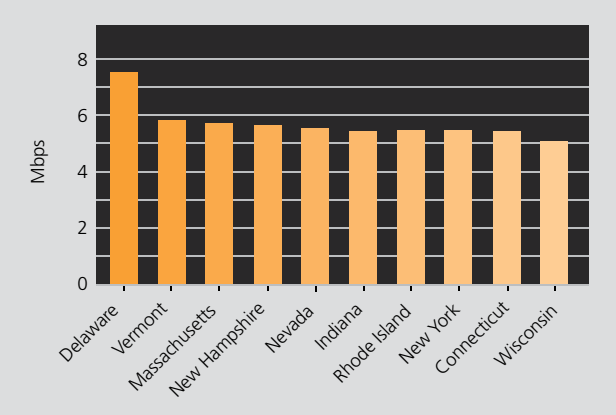


Figure 9: Average Measured Connection Speed by State

Overall, 31 states saw average connection speeds increase in the fourth quarter – up from 25 the prior quarter. Gains ranged from Oregon's slight 0.3% increase (to 4.3 Mbps) to South Dakota's 18% jump (to 4.5 Mbps). Fourth quarter decreases in average connection speeds were seen in 19 states and the District of Columbia, and ranged from West Virginia's 0.1% decline (to 4.1 Mbps) to Virginia's 13% drop (to 4.0 Mbps). Annual trending was roughly similar, with 21 states and the District of Columbia declining year-over year, from Connecticut's barely perceptible 0.1% drop (to 5.4 Mbps) to New Jersey's 25% loss (to 1.9 Mbps). Increased speeds year-over-year were seen in 29 states, from Kentucky's half-percent growth (to 3.3 Mbps) to the 33% growth seen in Hawaii (to 4.7 Mbps). We believe that the significant declines noted above in Virginia and New Jersey were likely due, in part, to increased traffic seen from lower speed mobile connections that entered the Internet through gateways within those states.

"College towns" are some of the best connected cities in the United States.

4.4 United States Average Connection Speeds, City View

In reviewing the "city view" average connection speed data published in the *3rd Quarter, 2009 State of the Internet* report, it was noted that many of the top cities listed for the United States had one or more colleges/universities within, or close to, the city. As was done for the global city view, for the fourth quarter United States data, we applied a "filter" of 50,000 unique IP addresses to qualify for inclusion in the list in an effort to filter out some of the particularly small cities that may have been included in the third quarter. Interestingly, the results once again show, as seen in Figure 10, that so-called "college towns" (cities) are some of the best connected in the United States. However, what this likely represents is the extremely high speed connections these university/college campuses have to the Internet, as opposed to particularly high speed consumer broadband services available to local residents. (However, it may also be the case that the speed of local consumer broadband offerings is potentially higher than average.)

In an effort to identify the fastest "big cities" within the United States, we also sorted the source data based on the number of unique IP addresses seen by Akamai. The data in Figure 11 represents the average measured connection speeds observed in the ten cities with the most unique IP addresses seen by Akamai. While Internet connections in these "big cities" are not quite as fast as the ones observed in "college towns", we can see that the connections from all of these cities are in the high broadband range, exceeding 5 Mbps. As such, users in these cities are likely prime candidates for the consumption of high-quality digital media, such as that available from companies that leverage Akamai's HD Network to deliver video streams encoded at HD quality.

	City	Q4 09 Kbps
1	Berkeley, CA	18730
2	Chapel Hill, NC	17483
3	Stanford, CA	16956
4	Durham, NC	13636
5	Ithaca, NY	13265
6	Ann Arbor, MI	13178
7	College Station, TX	13129
8	Urbana, IL	11764
9	Cambridge, MA	11708
10	University Park, PA	11066

Figure 10: Average Measured Connection Speed, Top United States Cities by Speed

	City	Q4 09 Kbps
1	New York, NY	5139
2	San Diego, CA	5258
3	Oakland, CA	6734
4	Las Vegas, NV	5597
5	Baltimore, MD	5428
6	Pittsburgh, PA	5054
7	San Jose, CA	6507
8	Rochester, NY	5220
9	Austin, TX	5804
10	Providence, RI	5148

Figure 11: Average Measured Connection Speed, Top United States Cities by Unique IP Count

4.5 Global High Broadband Connectivity

In the fourth quarter of 2009, more than one-fifth of the connections to Akamai were at speeds greater than 5 Mbps. This represents a gain of over 6% from the prior quarter, and more than 8% over the same quarter a year ago, as shown in Figure 12. In addition, a number of countries among the top 10 saw fairly significant quarterly growth (and corresponding jumps in yearly growth) in high broadband penetration levels. In some of these cases, the increase may be related to new or improved Akamai server deployments within the country – by delivering content from servers closer to end users, we can get a more "real-world" view of end-user connectivity, reducing the potential impact of distance-induced latency and packet loss that can occur over longer-distance network connections.

Reversing the positive trend seen over the past two quarters, South Korea saw a 7.5% decline in high broadband adoption in the fourth quarter. However, as noted above in Section 4.1, the launch of the Apple iPhone within South Korea in November apparently drove an associated increase in mobile usage/traffic in the country during the fourth quarter. As mobile speeds are generally well below high broadband levels, we believe that this was responsible for the quarterly decline.

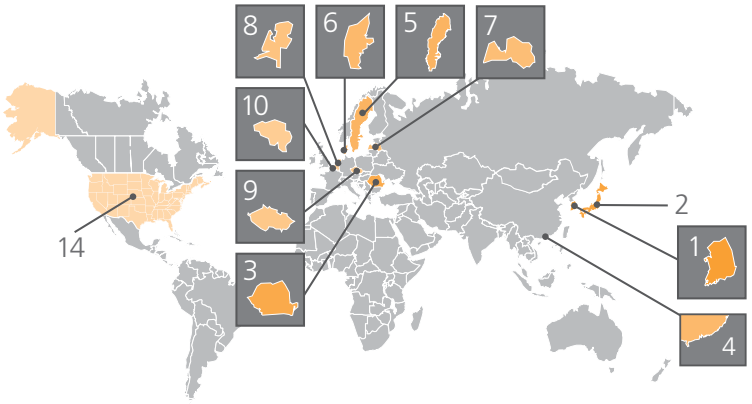


Figure 12: High Broadband Connectivity, Fastest Countries

	Country/ Region	% above 5 Mbps	QoQ Change	YoY Change
-	Global	21%	6.6%	8.2%
1	South Korea	68%	-7.5%	-1.6%
2	Japan	59%	-2.4%	8.5%
3	Romania	49%	8.1%	32%
4	Hong Kong	48%	22%	22%
5	Sweden	43%	1.9%	1.1%
6	Denmark	40%	19%	47%
7	Latvia	39%	55%	68%
8	Netherlands	38%	5.8%	35%
9	Czech Republic	36%	20%	67%
10	Belgium	34%	10%	19%
...				
14	United States	25%	5.6%	-0.1%

The global level of high broadband adoption, shown in Figure 13, grew nearly 12% quarter-over-quarter, but due to rounding, stayed flat at 0.01 high broadband IPs per capita. Across the top 10 countries with the highest levels of high broadband penetration, only South Korea and Japan saw lower levels than in the third quarter of 2009, seeing 2.6% and 0.5% declines respectively. Five countries, including the United States, saw quarterly increases in high broadband penetration rates of 10% or more. Though some positional shifting occurred, the pool of countries in the top 10 remained the same quarter-over-quarter.

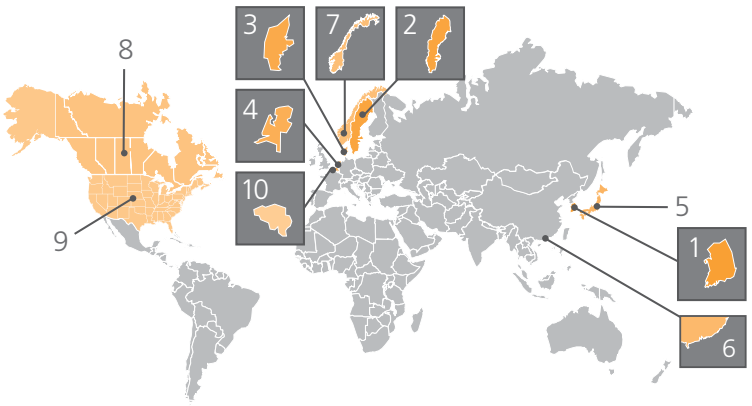


Figure 13: Global High Broadband Penetration

	Country/ Region	High Broadband IPs per Capita
-	Global	0.01
1	South Korea	0.23
2	Sweden	0.19
3	Denmark	0.16
4	Netherlands	0.15
5	Japan	0.15
6	Hong Kong	0.14
7	Norway	0.12
8	Canada	0.11
9	United States	0.10
10	Belgium	0.10

4.6 Global High Broadband Connectivity: Speed Distribution

In an effort to better understand the distribution of connections at speeds above 5 Mbps around the world, Akamai has done a more detailed analysis on these connections in order to publish more detailed data on the distribution of connection speeds, aggregated into 5 Mbps 'buckets,' as seen in Figure 14.

Though South Korea's percentage of high broadband percentages declined slightly in the fourth quarter, their concentration of connections between 5-10 Mbps increased slightly. Japan saw a similar trend in concentration shifts as well. Though it dropped from 16% in the third quarter to 10% in the fourth quarter, South Korea still has the largest percentage of extremely high-speed connections, with 10% of connections to Akamai at speeds over 25 Mbps. In the United States, the 5-10 Mbps 'bucket' grew by a percentage point, and the >25 Mbps 'bucket' shrank by a tenth of a percent.

We expect that, on a global basis, as the adoption and rollout of DOCSIS 3.0 technology by cable Internet providers, as well as other FTTH initiatives by telecom providers, become more widespread that the percentage of connections in the higher speed 'buckets' will grow over time. (Of course, this assumes that these providers are pricing the highest speed service tiers at a level that subscribers find affordable.)

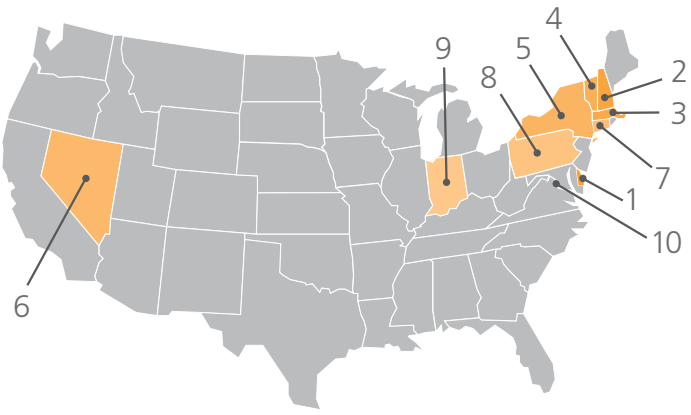
	Country/ Region	% above 5 Mbps	5-10 Mbps	10-15 Mbps	15-20 Mbps	20-25 Mbps	>25 Mbps
1	South Korea	68%	31%	15%	7.9%	4.6%	10%
2	Japan	59%	36%	15%	4.6%	1.7%	2.0%
3	Romania	49%	28%	13%	4.3%	1.8%	2.4%
4	Hong Kong	48%	27%	7.6%	4.1%	2.8%	6.6%
5	Sweden	43%	29%	7.6%	2.7%	1.2%	2.2%
6	Denmark	40%	33%	4.1%	1.0%	0.4%	0.7%
7	Latvia	39%	26%	6.5%	2.5%	1.3%	2.5%
8	Netherlands	38%	30%	4.8%	1.1%	0.5%	1.3%
9	Czech Republic	36%	29%	4.2%	1.1%	0.5%	1.5%
10	Belgium	34%	31%	2.1%	0.3%	0.1%	0.3%
…							
14	United States	25%	20%	2.6%	0.8%	0.4%	0.9%

Figure 14: High Broadband Connectivity, Distribution of Speeds

4.7 United States High Broadband Connectivity

Once again, Delaware recorded significant double-digit quarterly growth in the percentage of connections to Akamai at speeds above 5 Mbps, ending 2009 with 72% high broadband adoption, well ahead of second place New Hampshire, which ended the year with just over half of their connections to Akamai at speeds over 5 Mbps, as shown in Figure 15. While six of the top 10 states saw quarterly increases in their levels of high broadband adoption, four saw nominal quarterly declines.

Because the architecture of mobile networks within the United States has traffic entering the Internet from some limited number of "gateways", the states where these gateways are located may see associated declines in high broadband and broadband connectivity levels, as the mobile connections are at speeds well below broadband and high broadband levels, as was noted above in Section 3.3.



	State	% above 5 Mbps	QoQ Change	YoY Change
1	Delaware	72%	15%	17%
2	New Hampshire	51%	-3.4%	-7.4%
3	Massachusetts	45%	3.0%	5.2%
4	Vermont	44%	-0.7%	-3.3%
5	New York	44%	-3.2%	-1.7%
6	Nevada	41%	9.4%	7.4%
7	Connecticut	41%	1.9%	-0.7%
8	Pennsylvania	38%	17%	11%
9	Indiana	36%	17%	21%
10	District Of Columbia	36%	-3.1%	-0.3%

Figure 15: High Broadband Connectivity, Fastest U.S. States

Across the country, in the fourth quarter, 38 states saw quarterly increases in their levels of high broadband connectivity, ranging from a significant 81% increase in South Dakota (on top of a 40% gain in the third quarter) to a meager 0.3% increase in Montana. Quarterly declines in 12 states and the District of Columbia were seen in the fourth quarter, from Vermont's 0.7% decline to New Jersey's 11% loss. (And again, in analyzing the source data, we believe that New Jersey's decline was due to the growth of traffic coming from mobile network providers that have Internet gateways located within the state.) Year-over-year changes were evenly split, with 25 states improving their levels of high broadband adoption, while it appeared to get worse in 25 states and the District of Columbia.

Looking at the levels of high broadband penetration across the United States as calculated for the fourth quarter, shown in Figure 16, we note that penetration rates among the top 10 states increased in eight of the states, with modest increases in some states, though New Jersey, South Dakota, and Delaware saw unusually large, double-digit increases.

	State	High Broadband IPs per Capita
1	Massachusetts	0.20
2	New Jersey	0.19
3	New York	0.17
4	Rhode Island	0.15
5	Washington	0.15
6	South Dakota	0.14
7	Maryland	0.14
8	New Hampshire	0.14
9	Oregon	0.13
10	Delaware	0.13

Figure 16: High Broadband Penetration in the United States

(South Dakota's growth was unexpectedly high, with an 82% increase quarter-over-quarter.) By and large, over time, trending is generally positive as well, with 38 states and the District of Columbia increasing their levels of high broadband penetration over the course of 2009.

4.8 United States High Broadband Connectivity: Speed Distribution

In reviewing the ten states with the highest levels of high broadband connectivity, we find that, unsurprisingly, the highest concentration of connections are in the 5-10 Mbps bucket, accounting for between 72-90% of the high broadband connections in those states, as illustrated in Figure 17. The second largest concentration is among connections in the 10-15 Mbps range, ranging from 6-20% of the high broadband connections in those states, and the remainder appears to be clustered between 15-20 Mbps or above 25 Mbps. We expect that as the adoption and rollout of DOCSIS 3.0 technology by cable Internet providers, as well as other FTTH initiatives by telecom providers, become more widespread that the percentage of connections in the higher speed 'buckets' will grow over time, assuming that these providers are pricing the highest speed service tiers at levels that subscribers find affordable. In addition, as broadband stimulus funding is awarded and projects implemented, we expect that these numbers will likely grow in the future.

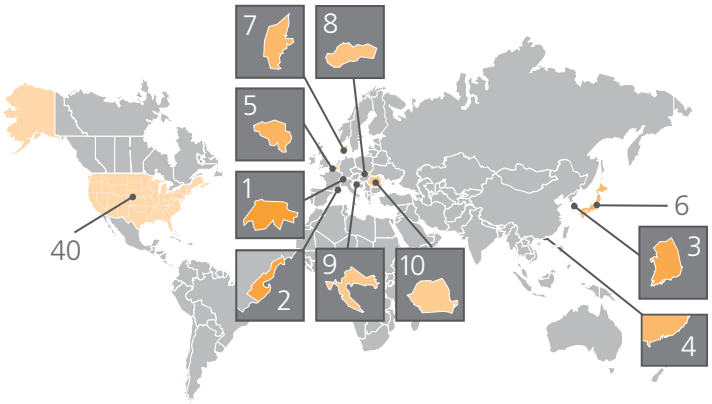
	State	% above 5 Mbps	5-10 Mbps	10-15 Mbps	15-20 Mbps	20-25 Mbps	>25 Mbps
1	Delaware	72%	58%	8.8%	2.7%	1.2%	1.7%
2	New Hampshire	51%	46%	3.3%	0.8%	0.4%	0.7%
3	Massachusetts	45%	36%	4.9%	1.5%	0.8%	1.8%
4	Vermont	44%	36%	4.3%	1.5%	0.8%	1.8%
5	New York	44%	36%	5.2%	1.2%	0.5%	1.0%
6	Nevada	41%	30%	8.2%	1.8%	0.6%	0.9%
7	Connecticut	41%	34%	3.7%	1.2%	0.7%	1.4%
8	Pennsylvania	38%	31%	4.6%	1.2%	0.5%	0.8%
9	Indiana	36%	29%	3.4%	1.2%	0.7%	2.1%
10	District Of Columbia	36%	26%	5.8%	1.8%	0.9%	1.9%

Figure 17: High Broadband Connectivity, Distribution of Speeds

4.9 Global Broadband Connectivity

As shown in Figure 18, the fourth quarter of 2009 saw nominal growth globally in broadband-level connections, with a 1.6% increase in the amount of connections to Akamai at speeds over 2 Mbps. Among the top 10 countries, Switzerland remained at greater than 90% broadband adoption, while Monaco's 4.8% quarterly growth pushed it to the 90% level as well. While the clustering has historically been evident among the top 10 countries, the range from #1 to #10 appears to be shrinking, with the fourth quarter's 5% gap being half of what was seen in the third quarter.

In the fourth quarter, South Korea dropped from first place down to third, with a nearly 5% quarterly decline. As discussed in Section 4.5, we believe that this was due to the growth in lower-speed mobile traffic related to the launch of the Apple iPhone in the country in late November 2009. Similarly, the 1.7% decline in the United States, dropping it from #35 to #40 in the global broadband adoption rankings, may also be attributable to the growth in mobile traffic.



	Country/ Region	% above 2 Mbps	QoQ Change	YoY Change
-	Global	54%	1.6%	-5.6%
1	Switzerland	91%	-0.7%	-1.0%
2	Monaco	90%	4.8%	4.8%
3	South Korea	89%	-4.9%	-4.7%
4	Hong Kong	89%	3.8%	-1.7%
5	Belgium	89%	0.1%	-0.2%
6	Japan	88%	-1.8%	-2.5%
7	Denmark	86%	1.9%	2.7%
8	Slovakia	86%	2.5%	1.5%
9	Croatia	86%	0.5%	29%
10	Romania	86%	1.7%	6.0%
...				
40	United States	56%	-1.7%	-11%

Figure 18: Broadband Connectivity, Fastest Countries

Only Switzerland and Monaco achieved 90% broadband adoption in the fourth quarter, with South Korea and Japan losing enough to drop them below the threshold. Globally, 111 countries increased their levels of broadband adoption from the third quarter, while 87 did so year-over-year. The number of countries that saw quarterly growth in the fourth quarter was more than double the number seen in the prior quarter, which is a positive sign.

Looking at the levels of broadband penetration around the world, as shown in Figure 19, we note that all but one of the countries in the top 10 increased their broadband penetration rates in the fourth quarter – Norway was the lone outlier, losing less than three-tenths of a percent (but leaving their overall broadband IPs per capita figure unchanged). The United States saw a 2.7% increase in the fourth quarter, but a 1.5% decline since the end of 2008. These generally increased levels of broadband penetration were seen in both quarters in the second half of 2009, potentially representing a longer term trend that reverses the declines that occurred in the first half of 2009.

Nine of the top 10 countries increased their broadband penetration rates in the fourth quarter of 2009.

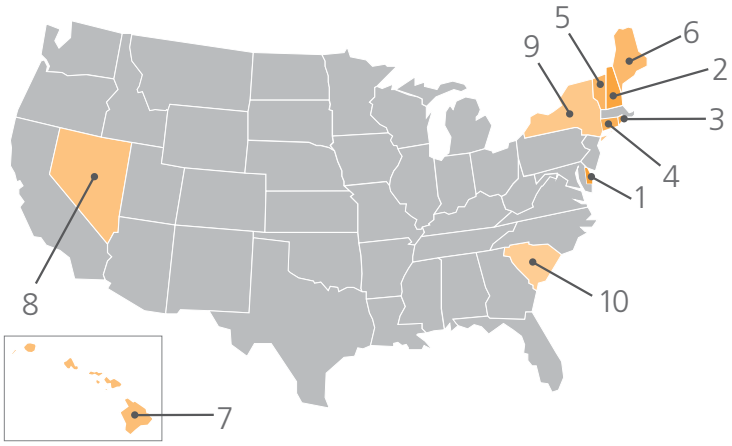
	Country/ Region	Broadband IPs per Capita
-	Global	0.04
1	Monaco	0.37
2	Denmark	0.34
3	Norway	0.34
4	Sweden	0.32
5	Netherlands	0.32
6	Iceland	0.32
7	Germany	0.31
8	Switzerland	0.30
9	South Korea	0.30
10	Hong Kong	0.27
...		
18	United States	0.23

Figure 19: Global Broadband Penetration

4.10 United States Broadband Connectivity

In the fourth quarter of 2009, relatively minor changes in levels of broadband adoption were seen among the top 10 states, with six of the states seeing gains/declines of less than 1% – South Carolina was the big mover with a 4.1% quarterly gain, as shown in Figure 20. The yearly changes were more significant, with changes ranging from a 2.6% gain in Hawaii to an 8.7% loss in Nevada. The yearly decline seen by nine of the top 10 states is reflected in the country as a whole, with 45 states and the District of Columbia seeing a drop year-over-year in the percentage of connections to Akamai at speeds over 2 Mbps. Only Alaska, Idaho, Montana, North Dakota, and Hawaii saw broadband percentages increase from the fourth quarter of 2008. The picture is not quite as grim from a quarterly perspective, as 31 states saw broadband adoption increase from the third quarter of 2009, while 19 states and the District of Columbia saw broadband adoption levels decline quarter-over-quarter.

Overall, we do not believe that this data is necessarily indicative of significant problems with the broadband infrastructure in the United States, nor do we believe that it points to insufficient availability of broadband services. Rather, as mentioned previously, we believe that mobile usage at sub-broadband speeds has grown to the point where it is exerting some amount of influence over the average data. In addition, as has been discussed in prior editions of this report, some manner of fluctuation is expected as connections just above or below the 2 Mbps threshold skew faster or slower over the course of the quarter, accounting for some of the observed change.



	State	% above 2 Mbps	QoQ Change	YoY Change
1	Delaware	97%	-0.7%	-0.9%
2	New Hampshire	88%	-0.4%	-2.3%
3	Rhode Island	85%	-0.1%	-3.3%
4	Connecticut	82%	0.9%	-6.1%
5	Vermont	82%	-1.5%	-2.0%
6	Maine	81%	-1.4%	-6.5%
7	Hawaii	80%	2.1%	2.6%
8	Nevada	78%	0.6%	-8.7%
9	New York	78%	-0.4%	-6.1%
10	South Carolina	75%	4.1%	-3.9%

Figure 20: Broadband Connectivity, Fastest U.S. States

In looking at the levels of broadband penetration across the United States as calculated for the fourth quarter of 2009, shown in Figure 21, we note that the penetration rates increased for eight of the top ten states, with only Hawaii and Rhode Island showing declines in the 1% range. Modest increases were seen in most other states in the top 10, though Virginia and New Jersey recorded double-digit percentage increases, which may be related, in part, to increased mobile traffic geo-located to these states, based on the locations of their Internet gateways, as discussed above in Section 4.3.

	State	Broadband IPs per Capita
1	Rhode Island	0.38
2	Massachusetts	0.34
3	New Jersey	0.33
4	New York	0.30
5	Georgia	0.29
6	Washington	0.29
7	South Dakota	0.29
8	Colorado	0.26
9	Virginia	0.25
10	Hawaii	0.25

Figure 21: United States Broadband Penetration

4.11 Global Narrowband Connectivity

In looking at narrowband connectivity, in contrast to the high broadband and broadband rankings, quarterly and yearly declines are considered to be a positive trend, as it likely indicates that higher speed connectivity is becoming more widely available and more widely adopted. However, while broadband adoption continues to increase in many countries across the world, many countries are still stuck with low-speed Internet connections, with large percentages of their connections to Akamai occurring at speeds below 256 Kbps. While the growth in mobile usage likely doesn't have a significant impact on the countries historically seen within the top 10, it may serve to inflate observed narrowband percentages within developed nations. As noted previously, starting with the *1st Quarter, 2010 State of the Internet* report, traffic from known mobile network providers will be removed from the data set used to calculate the metrics reported in this section. This change should help mitigate the impact that mobile usage has on narrowband connectivity statistics.

From a global perspective, the percentage of connections to Akamai at speeds below 256 Kbps increased a surprising 41% in the fourth quarter of 2009. This figure, however, is likely due to the massive growth in narrowband adoption in a number of developed countries – a massive 1300% increase in South Korea (likely related to significantly more mobile traffic in the fourth quarter), a 340% increase in Israel, and increases of more than 100% in 19 additional countries. Given their gains, South Korea and Israel ceded their positions as the countries with the lowest percentages of narrowband connections. In the fourth quarter, the lowest observed levels were in Belgium and France, with 1.0% and 1.1% respectively.

	Country/ Region	% below 256 Kbps	QoQ Change	YoY Change
-	Global	7.2%	41%	45%
1	Mayotte	99%	-0.1%	0.7%
2	Wallis and Futuna	97%	-1.3%	2.6%
3	Guyana	96%	3.1%	40%
4	Cuba	95%	-0.2%	2.0%
5	Ethiopia	92%	-1.6%	-0.9%
6	Malawi	91%	-4.0%	-2.6%
7	Equatorial Guinea	91%	-7.7%	7.5%
8	Madagascar	90%	5.3%	27%
9	Cook Islands	89%	-2.2%	5.2%
10	Vanuatu	88%	-9.5%	-0.8%
...				
104	United States	8.6%	84%	78%

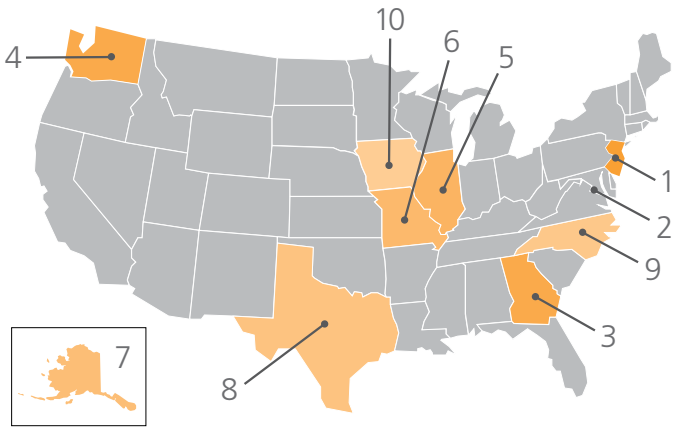
Figure 22: Narrowband Connectivity, Slowest Countries

Within the top 10 countries, as shown in Figure 22, Mayotte held essentially steady at 99% narrowband adoption, with a tiny 0.1% decline. Declines were also seen in seven other countries in the top 10, while only two recorded quarterly increases. Similar to the significant growth in the global figure, the United States saw an 84% increase in narrowband connectivity levels quarter over quarter. Consistent with prior quarters, many of the countries with the highest percentages of connections to Akamai at speeds below 256 Kbps were either island nations or on the African continent. In addition, Akamai sees comparatively few unique IP addresses from these countries, so their high percentage of narrowband connections is not entirely unexpected.

4.12 United States Narrowband Connectivity

The impact of growing mobile usage within the United States is particularly evident in narrowband connectivity figures for the United States in the fourth quarter of 2009. Published reports[7] indicated that the wireless industry within the United States showed the largest growth in three years, adding a total of approximately 5.9 million subscribers in the fourth quarter of 2009.

As noted previously, traffic from mobile carrier gateways will be geo-located to the state in which the gateway is located. We believe that this accounts for the triple-digit and high double-digit quarterly increases seen in many states in the fourth quarter, as shown in Figure 23. In fact, in re-analyzing the source data set with known mobile traffic removed, quarterly changes tended to be much more modest, and Alaska had the highest percentage of connections to Akamai at speeds below 256 Kbps, at 10%. Without mobile traffic, New Jersey drops to 20th place, with only 4.3% of connections at narrowband levels. In both cases, Delaware and Rhode Island have the lowest percentage of narrowband connections, at 1.3%



	State	% below 256 Kbps	QoQ Change	YoY Change
1	New Jersey	23%	144%	177%
2	District Of Columbia	17%	77%	68%
3	Georgia	14%	76%	78%
4	Washington	13%	154%	119%
5	Illinois	11%	104%	63%
6	Missouri	10%	42%	38%
7	Alaska	10%	8.8%	19%
8	Texas	9.6%	63%	86%
9	North Carolina	8.3%	100%	156%
10	Iowa	8.2%	14%	16%

Figure 23: Narrowband Connectivity, Slowest U.S. States

SECTION 5: Mobile

Building on the average measured connection speed data for three of the top mobile network providers in the United States published in the *3rd Quarter, 2009 State of the Internet* report, the data presented in this edition of the report is more global in nature. Average measured connection speeds on mobile network providers around the world for the fourth quarter of 2009 are shown, subject to the following constraints:

- Similar to Section 4, a minimum of 1,000 unique IP addresses connecting to Akamai in the fourth quarter was required to be considered for inclusion in the list.
- In countries where Akamai had data for multiple network providers, only the top three are listed, based on unique IP count.
- The names of specific mobile network providers have been anonymized, and providers will be identified by a unique ID.
- Data is included only for networks where Akamai believes that the entire Autonomous System (AS) is mobile – that is, if a network provider mixes traffic from fixed/wireline (DSL, etc.) connections with traffic from mobile connections on a single network identifier, that AS was not included in the source data set.
- Akamai's EdgeScape database was used for the continental assignments.

In examining the data shown in Figure 24, we see that there is a fairly wide range in average measured connection speeds, ranging from 3.2 Mbps on an Austrian mobile provider, down to 106 Kbps on a mobile provider in Slovakia. It is important to note that connection speeds on mobile networks can vary based on a number of factors, including device distance from mobile towers, device design (internal vs. external antennae), and ground speed of the devices (use in a moving vehicle vs. stationary use), as well as wireless data standards used (LTE, HSDPA, EV-DO, etc.).[8] Akamai has not cross-referenced the data standards used by the listed providers against the measured speeds.

Of the 109 mobile providers listed in Figure 24, over 40 had average measured connection speeds of over 1 Mbps in the fourth quarter, while 11 had broadband-level connectivity (connections to Akamai at speeds of 2 Mbps or greater). It is also interesting to observe the variances among multiple providers in selected countries – in Malaysia, the gap between the two listed providers is over 1 Mbps, while in Italy, there is a 2 Mbps gap between the fastest and slowest listed providers. (Though at an average measured connection speed of over 1 Mbps, mobile provider "IT-1" is still faster than many other mobile providers around the world.)

Looking at the results from the three mobile providers in the United States that were included in last quarter's report, we find that quarterly changes were mixed – mobile providers "US-1" and "US-3" saw average speeds decline 12% and 8% respectively, while the average speed on mobile provider "US-2" increased by just over 7% quarter-over-quarter.

SECTION 5: Mobile (continued)

It is not clear whether these speed declines were related to additional traffic due to new high-profile mobile devices being launched on these networks in the fourth quarter. On a year-over-year basis, "US-1" and "US-2" both ended 2009 with lower average measured connection speeds than were seen at the end of 2008, while "US-3" gained 6% over the course of the year. For comparison purposes, we have also included data for a leading WIMAX network provider in the United States – at an average measured connection speed of approximately 1.8 Mbps, they place within the top 20 mobile providers globally. This provider showed a quarterly speed gain of 11.5%, and a yearly gain of 5%.

REGION	ID	Q4 09 KBPS
Africa		
Egypt	EG-1	347
Morocco	MA-1	699
Nigeria	NG-1	302
South Africa	ZA-1	485
Asia		
China	CN-1	1915
Hong Kong	HK-1	1945
Hong Kong	HK-2	2002
Indonesia	ID-1	229
Israel	IL-1	1242
South Korea	KR-1	1332
Kuwait	KW-1	493
Malaysia	MY-1	216
Malaysia	MY-2	1392
Malaysia	MY-3	597
Pakistan	PK-1	796
Saudi Arabia	SA-1	2597
Singapore	SG-1	484
Singapore	SG-2	627
Singapore	SG-3	1174
Sri Lanka	LK-1	1366
Taiwan	TW-1	964
Taiwan	TW-2	303
Thailand	TH-1	607
Europe		
Austria	AT-1	3242
Austria	AT-2	1421
Belgium	BE-1	2528
Croatia	HR-1	1117
Czech Republic	CZ-1	903
Czech Republic	CZ-2	462
Czech Republic	CZ-3	1108
Estonia	EE-1	681
France	FR-1	417
France	FR-2	1321
Germany	DE-1	251
Germany	DE-2	1976
Greece	GR-1	868

REGION	ID	Q4 09 KBPS
Europe (Continued)		
Greece	GR-2	561
Hungary	HU-1	1431
Hungary	HU-2	1990
Ireland	IE-1	1511
Ireland	IE-2	1189
Ireland	IE-3	1200
Italy	IT-1	1237
Italy	IT-2	1446
Italy	IT-3	3206
Lithuania	LT-1	2018
Lithuania	LT-2	727
Moldova	MD-1	841
Moldova	MD-2	1455
Netherlands	NL-1	879
Netherlands	NL-2	1505
Norway	NO-1	797
Norway	NO-2	1191
Poland	PL-1	3120
Poland	PL-2	862
Poland	PL-3	748
Portugal	PT-1	341
Romania	RO-1	469
Russian Federation	RU-1	3209
Russian Federation	RU-2	732
Russian Federation	RU-3	750
Slovakia	SK-1	106
Slovakia	SK-2	1944
Slovenia	SI-1	1080
Spain	ES-1	1338
Spain	ES-2	613
Spain	ES-3	996
Ukraine	UA-1	163
United Kingdom	UK-1	1275
United Kingdom	UK-2	1830
United Kingdom	UK-3	2795
North America		
Canada	CA-1	2128
Canada	CA-2	672

REGION	ID	Q4 09 KBPS
North America (Continued)		
El Salvador	SV-1	470
El Salvador	SV-2	846
El Salvador	SV-3	694
Guatemala	GT-1	348
Guatemala	GT-2	489
Honduras	HN-1	618
Mexico	MX-1	653
Mexico	MX-2	871
Mexico	MX-3	456
Netherlands Antilles	AN-1	383
Nicaragua	NI-1	404
Puerto Rico	PR-1	2317
United States	US-1	617
United States	US-2	805
United States	US-3	684
United States	US-WIMAX	1801
Oceania		
Australia	AU-1	659
Australia	AU-2	424
Australia	AU-3	972
Guam	GU-1	411
New Caledonia	NC-1	374
New Zealand	NZ-1	1458
New Zealand	NZ-2	1200
South America		
Argentina	AR-1	326
Argentina	AR-2	463
Bolivia	BO-1	156
Brazil	BR-1	684
Brazil	BR-2	467
Chile	CL-1	681
Chile	CL-2	163
Chile	CL-3	506
Colombia	CO-1	651
Paraguay	PY-1	152
Paraguay	PY-2	369
Peru	PE-1	159
Peru	PE-2	505

Figure 24: Average Measured Connection Speed by Mobile Provider

SECTION 6: Appendix

REGION	% ATTACK TRAFFIC	UNIQUE IP ADDRESSES	UNIQUE IPs PER CAPITA	AVG SPEED (KBPS)	% ABOVE 5 MBPS	HIGH BB IPs PER CAPITA	% ABOVE 2 MBPS	BB IPs PER CAPITA	% BELOW 256 KBPS
Europe									
Austria	0.2%	1,987,559	0.24	3947	22%	0.05	69%	0.17	3.2%
Belgium	0.1%	2,998,312	0.29	4739	34%	0.10	89%	0.26	1.0%
Czech Republic	0.2%	1,628,134	0.16	5226	36%	0.06	77%	0.12	3.4%
Denmark	0.2%	2,176,073	0.39	5221	40%	0.16	86%	0.34	2.7%
Finland	0.1%	2,302,072	0.44	3557	19%	0.08	49%	0.21	3.5%
France	1.3%	21,477,486	0.33	3436	13%	0.04	73%	0.24	1.1%
Germany	4.4%	30,912,466	0.38	3914	19%	0.07	82%	0.31	2.6%
Greece	0.2%	1,892,929	0.18	3203	8.0%	0.01	70%	0.12	3.1%
Iceland	0.0%	121,135	0.39	4506	23%	0.09	82%	0.32	2.3%
Ireland	0.1%	1,288,641	0.30	3709	9.5%	0.03	48%	0.14	4.8%
Italy	4.5%	9,881,777	0.17	2804	5.2%	0.01	68%	0.12	2.8%
Luxembourg	0.0%	158,486	0.32	2678	5.9%	0.02	57%	0.18	3.2%
Netherlands	0.5%	6,906,785	0.41	5329	38%	0.15	78%	0.32	4.6%
Norway	0.1%	2,296,474	0.49	4325	24%	0.12	69%	0.34	4.8%
Portugal	0.6%	2,004,683	0.19	3772	20%	0.04	78%	0.15	1.2%
Spain	1.3%	10,822,929	0.27	2898	7.0%	0.02	68%	0.18	2.4%
Sweden	0.2%	3,903,246	0.43	6082	43%	0.19	75%	0.32	4.6%
Switzerland	0.2%	2,551,227	0.33	5050	26%	0.09	91%	0.30	1.9%
United Kingdom	1.0%	20,008,664	0.33	3706	17%	0.06	76%	0.25	2.1%
Asia/Pacific									
Australia	0.3%	7,938,769	0.37	2095	6.9%	0.03	35%	0.13	7.7%
China	7.5%	52,113,869	0.26	857	0.3%	<0.01	6.0%	<0.01	4.5%
Hong Kong	0.3%	2,136,747	0.30	8568	48%	0.14	89%	0.27	3.3%
India	3.3%	3,553,710	<0.01	849	0.6%	<0.01	5.8%	<0.01	26%
Japan	2.9%	32,259,547	0.25	7613	59%	0.15	88%	0.22	2.2%
Malaysia	1.0%	1,397,051	0.05	1070	1.2%	<0.01	7.2%	<0.01	18%
New Zealand	0.2%	1,249,535	0.29	2967	9.2%	0.03	64%	0.19	8.2%
Singapore	0.4%	1,561,192	0.33	2624	13%	0.04	50%	0.17	15%
South Korea	1.6%	16,108,106	0.33	11717	68%	0.23	89%	0.30	3.4%
Taiwan	5.5%	5,927,361	0.26	4095	26%	0.07	59%	0.15	4.5%
Middle East									
Egypt	0.3%	968,646	0.01	676	0.2%	<0.01	4.0%	<0.01	19%
Israel	0.6%	1,942,758	0.26	2650	3.3%	0.01	51%	0.13	1.5%
Kuwait	0.1%	196,146	0.07	1494	4.5%	<0.01	22%	0.02	16%
Saudi Arabia	0.6%	1,250,507	0.04	2111	1.9%	<0.01	42%	0.02	2.6%
Sudan	0.0%	14,949	<0.01	597	--	<0.01	--	<0.01	25%
Syria	0.0%	63,441	<0.01	1451	7.7%	<0.01	19%	<0.01	59%
United Arab Emirates (UAE)	0.2%	380,029	0.08	1615	7.7%	0.01	21%	0.02	29%
Latin & South America									
Argentina	3.1%	3,480,100	0.08	1202	0.5%	<0.01	9.3%	0.01	8.6%
Brazil	6.4%	10,779,132	0.05	1312	2.2%	<0.01	18%	0.01	17%
Chile	0.5%	1,834,868	0.11	2262	3.8%	<0.01	47%	0.05	4.5%
Colombia	1.3%	1,943,418	0.04	1664	0.8%	<0.01	30%	0.01	4.5%
Mexico	0.4%	7,413,181	0.07	1352	0.5%	<0.01	13%	0.01	3.3%
Peru	0.7%	619,591	0.02	988	--	<0.01	4.3%	<0.01	5.1%
Venezuela	0.3%	1,675,718	0.06	813	--	<0.01	3.6%	<0.01	13%
North America									
Canada	1.4%	11,402,213	0.34	4720	33%	0.11	78%	0.26	3.1%
United States	12%	124,953,865	0.40	3808	25%	0.10	56%	0.23	8.6%

SECTION 7: Endnotes

[1] http://isc.sans.org/port.html?port=445

[2] http://www.census.gov/ipc/www/idb/

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[8] http://en.wikipedia.org/wiki/Comparison_of_wireless_data_standards

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Acknowledgements

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